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ABSTRACT

The costs of creating and maintaining permanent files and retrieving keyword title indexes in TRIAL (Technique for Retrieving Information from Abstracts of Literature) are presented. This system, which is used for bibliographic control and file efficiency, is relatively easy to learn and use, and popular with school, academic, business, and governmental personnel. Large data bases are anticipated, and the costs for building 1000, 3000, 5000, 7000, and 9000 record data bases are reported here based on a model devised to show how most users use TRIAL. Results show that costs are linear in relation to the number of records needed, and that each record costs approximately seven and one-half cents to process. (Author/MBR)

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COST ANALYSIS OF TRIAL, an INFORMATION STORAGE and RETRIEVAL SYSTEM

BASED on the ACCOUNTING ALGORITHM at the UNIVERSITY OF COLORADO - BOULDER

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June, 1978

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Abstract

TRIAL (Technique for Retrieving Information from Abstracts of Literature) is an information storage and retrieval system, used for bibliographic control and file efficiency, using the computer. Since the system is relatively easy to learn and use, TRIAL became rather popular to school, academic, business, and governmental personnel.

Large data bases were anticipated, yet the costs for building large data bases were not available. Thus, this report records the costs of building large data bases for 1000 records, 3000 records, 5000 records, 7000 records, and 9000 records.

A model was devised on how most users use TRIAL, and the costs of creating permanent files and retrieving keyword title indexes were recorded based on this model.

Results showed that costs are linear in relation to the number of records needed and that each record costs approximately 7½ cents to process.

The reader should consult the ERIC document (IR 005 802), entitled LM 535, Information Storage and Retrieval; TRIAL: Producing Media Catalogs, to learn how to build a TRIAL data base.

Chapter 1. TRIAL Study

Introduction

TRIAL stands for Technique for Retrieving Information from Abstracts of Literature. TRIAL is an information storage and retrieval system, written originally in machine language at Northwestern University in 1964. Since that time, TRIAL has been revised and written in FORTRAN with both CDC and IBM versions. This information package is one of the programs available in the library of programs at the University of Colorado's Computing Center in Boulder, Colorado.

TRIAL is suitable for any situation which requires bibliographic control of materials and for general file efficiency. Thus, it is generally used by school media specialists to generate indexes and catalogs of both print and non-print materials as well as by academic librarians for the same purpose. TRIAL, as stated, is used for general file efficiency to maintain records of a student's advisor, degree expectation, admittance date, in addition to general information: student's name, address, and phone number.

Purpose of Cost Analysis

Because of the many applications of TRIAL, the system became rather attractive to the University community as well as to the business and governmental communities. Those concerned with bibliographic needs began to create data bases on a test basis to ascertain whether the output of the data base would satisfy actual and potential users.

Once the output proved beneficial to users, larger data bases were anticipated and plans for building larger data bases were begun. Yet, there were concerns not only of the costs involved but whether TRIAL could handle many records. Consequently, research was needed to 1. maintain a log of cost factors of TRIAL, and 2. check the capacity of TRIAL. Details of the research will be explained after an explanation of how TRIAL is constructed.

Structure of TRIAL

TRIAL is built on nine levels of information, and any information can be placed in any level. The structure looks like this:

INFORMATION	1
INFORMATION	2
INFORMATION	3
INFORMATION	4
INFORMATION	5
INFORMATION	6
INFORMATION	7
INFORMATION	8
INFORMATION	9

The information is typed on computer cards, and the TRIAL program distinguishes among the levels by the number typed in column 75. The information for these nine levels constitute a record about one object, such as a book, a periodical, a film, a filmstrip; etc. The record is made up of nine fields. Many records make up a file, and many files make up a data base.

For complete information on how to construct a data base in TRIAL, the reader should consult the ERIC document, entitled LM 535, Information Storage and Retrieval; TRIAL: Producing Media Catalogs (IR 005 802).

Chapter 2. Implementation

A committee was established to discuss the information storage and retrieval needs of the university and other users. One of the recommendations of the committee was that the cost of TRIAL be analyzed. Since costs are related to the number of records making up the data base as well as the number of levels used in each record, the committee discussed possible formats that should be tested. Two formats were agreed upon: 1. a format that is used presently by most of the users, and 2. a format in which each level is packed with at least ten cards in each level.

Format 1

Since the format used by most users is one taught in this author's class, entitled LM 535, Information Storage and Retrieval, it was decided that this format be used as the model for testing.

The model (Table 1) presents the levels used for each record and the number of cards for each level. It should be pointed out that most of the TRIAL users use the system to generate media catalogs for school libraries.

The media catalogs list the non-print items which are housed in the school media center. The catalogs that are produced using TRIAL are handed to the teachers. While the teachers are preparing their class lessons, they can immediately check the catalogs to find out what materials the library possesses which can aid in the instruction based on the objectives of the unit.

With this use in mind, the model can be explained as follows. In Level 1, the classification number (Dewey, Library of Congress, or an accession number) is keypunched in columns 61 through 72 with the number 1 keypunched in column 75

McWeeney Model

	Level	
Classification	1	1 card
Title of the non-print medium	2	1 to 2 cards
Producer	4	1 card
Type of medium	5	1 card
Abstract	6	1 or 2 cards
Age Level	7	1 card
Subject Headings	8	1 card
Location	9	1 card

Model Used to Test Costs of TRIAL

Table 1

on one computer card. The level number is always keypunched in column 75 on each and every card. The title of the non-print item is keypunched on one or two cards in Level 2. The producer of the item is punched on one card in Level 4. (Level 3 is usually reserved for titles of periodicals.)

The type of medium (filmstrip, slide set, kit, transparency; etc.) is typed on one card in Level 5. A short abstract, explaining the subject content of the item, is keypunched on one or two cards in Level 6. Age level, typed in Level 7, refers to the level of difficulty or the audience for whom the item is intended; eg, Grades 7 to 9. Subject headings are placed in Level 8. Usually, the Sears list of subject headings are used or a list of headings more suitable for a particular audience. Location means the name of the school or the area within a school where the item is housed.

The structure of TRIAL does not necessitate the placing of certain information in any particular level. The information keypunced in a level is the prerogative of the person building the file. Thus, the title could just as easily be placed in Level 5 as it is placed in Level 2. Consistency is the only requirement demanded in building the file so the output is understandable.

Format 2

In addition to recording the cost of TRIAL based on the model, the committee requested that costs be determined for a file in which each record would be packed with ten cards in each of the nine levels. It was believed that higher costs are related to the amount of information contained in each level and not necessarily to the number of records in the file.

Putting the problem in another way, the committee believed that 200 records with each record packed with ten cards in each of the nine levels would be more expensive than 500 or 600 records with each record constructed according to the model. If this belief turned out to be true, the costs would be determined not by the number of records but by the compactness of each record.

Results would be informative to people in the business community who need a system allowing compactness yet low in costs. Testing both formats would provide information to the two categories of users: those who need a low cost system of many records with concise information in each level and those who need a low cost system of a few thousand records with an abundant amount of information in each level.

Breakdown Costs

The committee anticipated that costs would be exponential at some point while incrementing the data base by 2000 records. Since the Day File lists the breakdown costs, the interval which showed the greatest increase in cost should be pinpointed and explained.

Resources and Testing Procedure

After the committee decided the formats that needed to be tested and analyzed, Professor Tom Boardman, the Associate Director of the Computing Center at the University of Colorado, was contacted to support the project. Since such a report would be beneficial for all users, funds were set aside to undertake the project.

A graduate student in the Library Media program, Becky Bacon, a person highly qualified because of her experience in building data bases in TRIAL was asked to work on the project with the assistance of Karin Bruce, the Computing Center's administrator of library programs. Financial assistance was awarded to Becky Bacon from the Boulder Criminal Correction Center, a center interested in the possible use of TRIAL.

During the month of April, 1978, the testing phase of the project was undertaken, using the CDC 6400 computer at the main Computing Center at the University of Colorado - Boulder.

System of Testing

A file of two hundred records, created previously to the undertaking of the project, was used as the source deck. Each record reflected the model record with each record containing eight levels. The deck was duplicated five times to produce a thousand records.

The procedure of testing the costs proceeded according to the following steps:

1. the creation of a permanent file of 1000 records and the recording of costs, as reported on the Day File, of the permanent file as well as the breakdown costs;
2. the retrieving of a keyword title index from Level 2 and the recording of costs, as reported on the Day File,as well as the breakdown costs; and
3. increasing the amount of records by 2000 record intervals, up to 9000 records and repeating steps 1 and 2.

Thus, a permanent file was generated for 1000 records, 3000 records, 5000 records, 7000 records, and 9000 records. Each time a permanent file was generated, the cost as reported on the Day File was recorded as well as the breakdown costs. Likewise, a keyword title index was retrieved from 1000 records, 3000 records, 5000 records, 7000 records, and 9000 records. Each time the keyword title index was generated, the cost as reported on the Day File was recorded as well as the breakdown costs.

Five hundred stopwords were used each time a keyword title index was retrieved. Stopwords are words like a, an, the. Ususally, stopwords consist of prepositions, conjunctions, interjections, and verbs. Words other than stopwords would then appear on the output.

Prior to the testing phase of the project, the original source deck consisting of 200 records was used to determine what words should be stopwords to retrieve an accurate output. Five hundred stopwords were needed to produce an accurate output.

An index can be retrieved from each of the nine levels, yet only the costs of retrieving one index, a keyword title index from Level 2 was recorded. The reason for testing this type of index was based on knowing that this type of index was the most expensive because of sorting all the words from titles and testing each word from a list of stopwords. Retrieving indexes from other levels would consequently be less expensive than Level 2. Thus, the worse possible case, the most expensive case, was tested.

Chapter 3. Results

This chapter will present the costs of using TRIAL. There are two categories of costs: 1. total costs for generating permanent files and retrieving indexes and 2. the breakdown of total costs. Total costs are determined by five factors: Processing, Memory Occupancy, Mass Storage, I/O Processing and I/O Materials.

As stated in Chapter 2, two formats would be tested: 1. a format based on the McWeeney model and 2. a format in which each level would be packed with at least ten cards in each level. Format 2 was never tested because of the expense and time of testing the model. Consequently, only the costs involved in testing Format 1 based on the model will be presented.

Cost will be presented in the following way according to the two categories of Costs:

1. Permanent File Costs - Total,
2. Permanent File Costs - Breakdown,
3. Keyword Title Index Costs - Total, and
4. Keyword Title Index Costs - Breakdown.

Total and breakdown costs will be given with the following information: Number of Records, Costs, Record Cost Difference (RCD), Greatest Cost Difference(GCD), Increase or Decrease in costs (I or D) and an asterisk (*) marking the greatest cost difference. Record Cost Difference (RCD) is determined by the difference of the two total costs based on incrementing the data base by 2000 records. Greatest Cost Difference (GCD) is determined by the difference of the two RCD costs based on incrementing the data base by 2000 records.

Permanent File Costs - Total

As indicated on Figure 1, there is a linear relationship between the number of records in the permanent file and the costs. Table 2 shows these costs as well as the differences in costs.

Table 2

Permanent File Costs - Total

Number of Records	Total Costs	RCD	GCD	I or D	*
1000	34.74				
		68.32			
3000	103.06		4.44	D	*
		63.88			
5000	166.94		2.67	I	
		66.55			
7000	233.49		1.71	D	
		64.84			
9000	298.33				
Range		4.44			

The Day Files for each of these permanent files are included in the Appendix and are so marked.

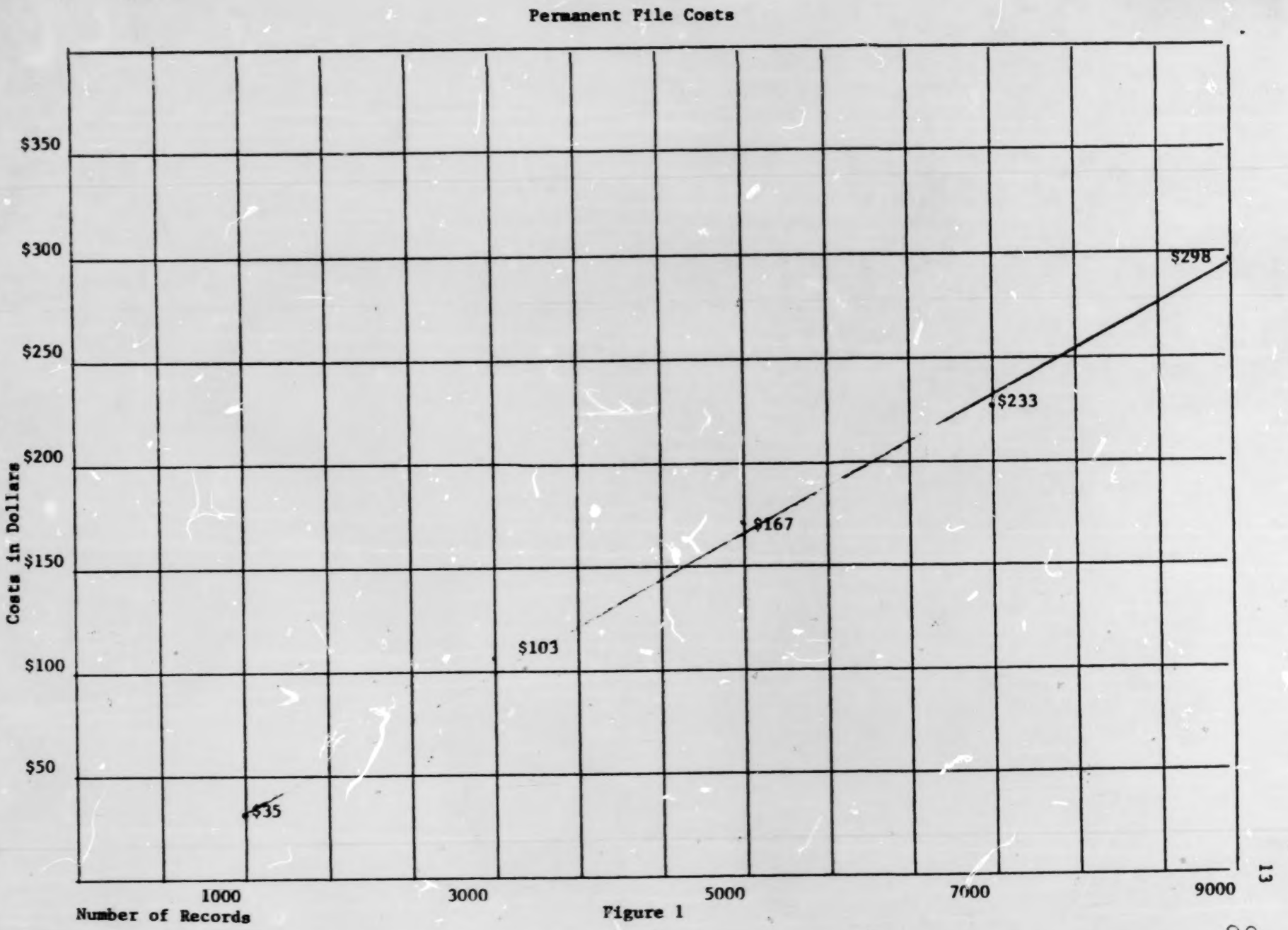
Permanent File Costs
$350
$300
$250
$200
$150
$100
$50
Costs in Dollars
$298
$233
$167
$103
$35
1000
3000
5000
7000
9000
Number of Records

Figure 1

13

Permanent File Costs - Breakdown

As stated previously, the total cost is made up of five factors: Processing, Memory Occupancy, Mass Storage, I/O Processing, and I/O Materials. The following Tables show these costs as well as the differences in costs. The Day Files for each of these permanent files are included in the Appendix and are so marked. The costs in column 2 are stated on the Day Files under the appropriate headings.

Table 3

Processing

Number of Records	Costs	RCD	GCD	I or D	*
1000	3.56				
		7.07			
3000	10.63		1.29	D	*
		5.78			
5000	16.41		0.72	I	
		6.50			
7000	22.91		0.43	D	
		6.07			
9000	28.98				
Range		1.29			

Table 4

Memory Occupancy

Number of Records	Cost	RCD	GCD	I or D	*
1000	11.93				
		23.76			
3000	35.69		0.14	D	
		23.62			
5000	59.31		0.11	D	
		23.51			
7000	82.82		0.58	D	*
		22.93			
9000	105.75				
Range		0.58			

Table 5

Mass Storage

Number of Records	Cost	RCD	GCD	I or D	*
1000	5.40				
		10.01			
3000	15.41		3.02	D	*
		6.99			
5000	22.40		2.04	I	
		9.03			
7000	31.43		0.68	D	
		8.35			
9000	39.78				
Range		3.02			

Table 6

I/O Processing

Number of Records	Cost	RCD	GCD	I or D	*
1000	12.39				
		24.63	-		
3000	37.02				
		24.63	-		
5000	61.65				
		24.64	-		
7000	86.29				
		24.63	-		
9000	110.92				

Table 7

I/O Materials

Number of Records	Cost	RCD	GCD	I or D *
1000	1.46			
		2.85	-	
3000	4.31			
		2.86	-	
5000	7.17			
		2.87	-	
7000	10.04			
		2.86	-	
9000	12.90			

Keyword Title Index Costs - Total

As indicated on Figure 2, there is a linear relationship between the number of records retrieved from the permanent file and the costs. Table 8 shows these costs as well as the differences in costs.

Table 8

Keyword Title Index Costs - Total

Number of Records	Total Costs	RCD	GCD	I or D	*
1000	39.27				
		78.05			
3000	117.32		14.11	I	*
		92.16			
5000	209.48		3.33	I	
		95.49			
7000	304.97		9.74	D	
		85.75			
9000	390.72				
Range		17.44			

The Day Files for each of these indexes are included in the Appendix and are so marked.

Keyword Title Index Costs - Breakdown

As stated previously, the total cost is made up of five factors: Processing, Memory Occupancy, Mass Storage, I/O Processing, and I/O Materials. The following Tables show these costs as well as the differences in costs. The Day Files for each of these indexes are included in the Appendix and are so marked. The costs in column 2 are stated on the Day Files under the appropriate headings.

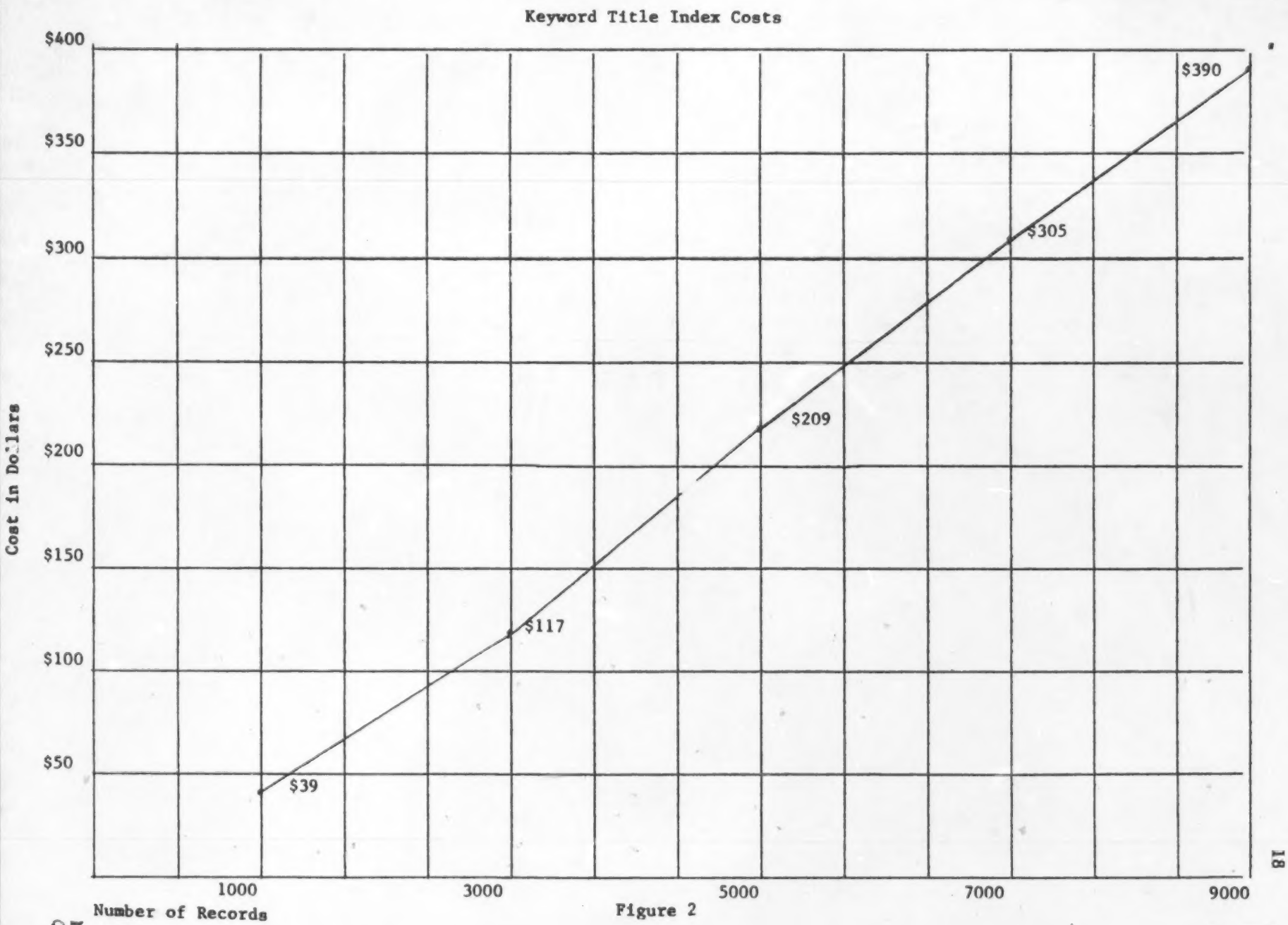
Keyword Title Index Costs
$400
$350
$300
$250
$200
$150
$100
$50
Cost in Dollars
$390
$305
$209
$117
$39
1000
3000
5000
7000
9000
Number of Records

Figure 2

Table 9

Processing

Number of Records	Costs	RCD	GCD	I or D	*
1000	4.87				
		9.32			
3000	14.19		2.04	I	*
		11.36			
5000	25.55		0.60	I	
		11.96			
7000	37.51		1.41	D	
		10.55			
9000	48.06				
Range		2.64			

Table 10

Memory Occupancy

Number of Records	Cost	RCD	GCD	I or D	*
1000	18.95				
		39.94			
3000	58.89		7.96	I	*
		47.90			
5000	106.79		2.28	I	
		50.18			
7000	156.97		6.08	D	
		44.10			
9000	201.07				
Range		10.24			

Table 11

Mass Storage

Number of Records	Cost	RCD	GCD	I or D	*
1000	6.74				
		11.99			
3000	18.73		4.19	I	*
		16.18			
5000	34.91		0.29	I	
		16.47			
7000	51.38		2.18	D	
		14.29			
9000	65.67				
Range		4.48			

Table 12

I/O Processing

Number of Records	Cost	RCD	GCD	I or D	*
1000	7.75				
		14.97			
3000	22.72		0.07	I	
		14.90			
5000	37.62		0.15	I	*
		15.05			
7000	52.67		0.07	D	
		14.98			
9000	67.65				
Range		0.15			

Table 13

I/O Materials

Number of Records	Cost	RCD	GCD	I or D *
1000	0.96			
		1.83	-	
3000	2.79			
		1.82	-	
5000	4.61			
		1.83	-	
7000	6.44			
		1.82	-	
9000	8.27			
Range		0.01		

Chapter 4. Questions and Conclusions

This chapter will pose questions about the results and present plausible answers in addition to drawing general statements about the costs.

Questions and Answers

In both the Permanent File Costs - Total (Table 2) and the Keyword Title index Costs - Total (Table 8), the Record Cost Differences are not equal. The question to pose is, Why are the differences not of equal amounts since the increments (2000 records) are equal. The answer to this question will itself pose another question; but first, the answer.

The range of the RCD (Table 2) is small ($4.44) in relation to the range of the RCD (Table *) which is $17.44. The reason why Record Cost Differences are not of equal amounts can be attributed to the breakdown costs of the five factors: Processing, Memory Occupancy, Mass Storage, I/O Processing, and I/O Materials.

Processing and Mass Storage costs account for the RCD in Table 2. Processing, Memory Occupancy, and Mass Storage costs account for the RCD in Table 8. Neither I/O Processing nor I/O Materials play any significant role in determining unequal amounts in RCD.

The answer itself poses another question, Why are the breakdown costs not of equal amounts since the increments (2000 records) are equal? The answer to this question is nebulous, but the best reply is, Though the accounting algorithm is quite accurate, the accounting algorithm is not perfect.

Conclusions

General statements about costs are these:

1. The costs of I/O Processing and I/O Materials are equal based on the RCD and do not influence variations in total costs;
2. Processing, Memory Occupancy, and Mass Storage are the three of the five factors in the breakdown costs which influence variations in total costs;
3. In creating permanent files, Mass Storage is the main factor influencing total cost, while Memory Occupancy is the main factor influencing total cost in retrieving a keyword title index. This statement is based on the Greatest Cost Difference (GCD) from analyzing the Tables.
4. In generating permanent files, incrementing the data base from 1000 to 3000 records is more costly than incrementing the data base by 2000 records at other interval points. This statement is based on the RCD from analyzing the Tables.
5. In retrieving indexes, incrementing the data base from 5000 to 7000 records is more costly than incrementing the data base by 2000 records at other interval points. This statement is based on the RCD from analyzing the Tables.
6. There is a slight decrease in RCD when the data base is incremented by 2000 records between 7000 and 9000 records.
7. At no interval of incrementing the data base by 2000 records is there a great increase in costs.

In all these statements about costs, there is less than a $25.00 difference in the range of the RCD as indicated on the Tally Sheet.

Tally Sheet

This sheet summarizes the costs of using TRIAL by number of records.

Number of Records	Permanent File	Keyword Title Index	Total	RCD
1000	34.74	39.27	74.01	
				146.37
3000	103.06	117.32	220.38	
				156.04
5000	166.94	209.48	376.42	
				162.04
7000	233.49	304.97	538.46	
				150.59
9000	298.33	390.72	689.05	
Range				15.67

Dividing total costs by the number of records, each record costs approximately 7½¢ in permanent file and processing costs.

Appendixes

This section includes the Day Files of Permanent file costs, Keyword Title Index costs, and the breakdown of the total costs. The breakdown of the total costs appears on the Day Files under the appropriate headings: Processing, Memory Occupancy, Mass Storage, I/O Processing, and I/O Materials.

In addition, the operating system commands and the TRIAL command statements are included and are so marked. These commands must be used when building large data bases. When constructing smaller data bases (less than 2000 records), the reader should consult the ERIC document entitled, LM 535, Information Storage and Retrieval: TRIAL: Producing Media Catalogs (IR 005 802).

Appendix A

Permanent Files - Day Files

```
JOB COST  J072CCB  PTCA/J072 78/03/24  16.11.39   $   34.74 (NORMAL)

 PROCESSING                                       $    3.56
   CP                  52  SEC        $    1.30
   PP                 127  SEC        $    2.26
 MEMORY OCCUPANCY                                 $   11.93
   CM                1807  WD-HRS     $   11.93
 MASS STORAGE                                     $    5.40
   MSPRU            12393  PRU        $    0.75
   MSACC             2513  ACC        $    4.65
 I/O PROCESSING                                   $   12.39
   LP               15078  LINES      $   12.37
   CR                  17  CARDS      $    0.02
 I/O MATERIALS                                    $    1.46
   LP                242  PAGES      $    1.46
                                                  ---------
 TOTAL COST                                       $   34.74

 PF ACCUMULATION RATE PER DAY          $    2.13
 ACCOUNT BALANCE                       $  364.98


         J072CCB.   78/03/24. CU16 KRONOS 2.1 - 9.1

14.21.06.J072,CM=132000,TL=100.
14.21.06. CCID/PW VALIDATED.
14.21.06.PROJECT,PTCA.
14.21.08.SETLIM(PR=500)
14.21.08.ATTACH,TRIAL/PJ=PLIB,ID=POOL.
14.21.09.GET,TAPE1=031000/POOL.
14.22.15.TRIAL.
14.22.15.* ENTER TRIAL
14.22.16.* ENTER EDIT
16.11.02.* END EDIT
16.11.02.      END  TRIAL
16.11.02.     51.348 CP SECONDS EXECUTION TIME
16.11.02.SAVE,TAPE2=T1000.
16.11.24.REWIND,TAPE6.
16.11.24.COPYRF,BF,TAPE6.
16.11.39.EOI ENCOUNTERED      0 FILES
16.11.40.JOBEND.     $   34.74
```

Permanent File - 1000 Records

```
JOB COST  J072CCP   PTCA/J072 78/04/07  13.02.49   $  103.06 (NORMAL)

 PROCESSING                                        $   10.63
   CP                  165  SEC        $    4.12
   PP                  367  SEC        $    6.51
 MEMORY OCCUPANCY                                  $   35.69
   CM                 5407  KD-HRS     $   35.69
 MASS STORAGE                                      $   15.41
   MSPRU             43867  PRU        $    2.64
   MSACC              6899  ACC        $   12.77
 I/O PROCESSING                                    $   37.02
   LP                45118  LINES      $   37.00
   CR                   18  CARDS      $    0.02
 I/O MATERIALS                                     $    4.31
   LP                  718  PAGES      $    4.31
                                                   ---------
 TOTAL COST                                        $  103.06

 PF ACCUMULATION RATE PER DAY          $   15.05
 ACCOUNT BALANCE                       $  155.52


         J072CCP.   78/04/07. CU16 KRONOS 2.1 - 9.1


12.11.39.J072,CM=132000,TL=3.0.
12.11.40. CCID/PA VALIDATED.
12.11.40.PROJECT PTCA.
12.11.41.SETLIM(PR=10000)
12.11.41.ATTACH,TRIAL/UN=PLIB,ID=POOL.
12.11.42.GET,TAPE1=030000/POOL.
12.16.04.TRIAL.
12.16.06.* ENTER TRIAL
12.17.31.* ENTER EDIT
13.01.10.* END EDIT
13.01.10.      END, TRIAL
13.01.10.    153.356 CP SECONDS EXECUTION TIME
13.01.10.DEFINE,T3000.
13.01.32.COPY,TAPE2,T3000.V.
13.01.32. END OF INFORMATION ENCOUNTERED.
13.01.53. VERIFY COMPLETED.
13.01.53.REWIND,TAPE3.
13.01.53.COPYBF,BF,TAPE3.
13.02.49.EOI ENCOUNTERED      0 FILES
13.02.50.JCBEND.     $  103.06
```

Permanent File - 3000 Records

```
JOB COST  J072000  RTCA/JC72 78/04/12  15.49.02   $  166.94 (NORMAL)

PROCESSING                                          $   16.41
  CP                  279  SEC       $    6.86
  PP                  588  SEC       $    9.55
MEMORY OCCUPANCY                                    $   59.31
  CM                 8038  KO-HRS    $   59.31
MASS STORAGE                                        $   22.40
  MSPRO             21401  PRU       $    3.69
  MSALL              1011  ACC       $   18.71
I/O PROCESSING                                      $   61.65
  LP                75153  LINES     $   61.63
  CR                   18  CARDS     $    0.02
I/O MATERIALS                                       $    7.17
  LP                 1105  PAGES     $    7.17
                                                    --------
TOTAL COST                                          $  166.94

PF ACCUMULATION RATE PER DAY        $   25.69
ACCOUNT BALANCE                     $  699.16

        J072000.   78/04/12. CU16 KRONOS 2.1 - 9.1

13.53.21.J072.CM=132000,TL=600.
13.53.23.  USID  IS VALIDATED.
13.53.23.  ...  ...  ...
13.53.25.SET,...=8000.
13.53.25.ATTACH,TRIAL/UN=...LIB.ID=POOL.
13.53.27.  ...  TRIAL/...000/POOL.
13.54.03.  ...
13.54.05.* ENTER TRIAL
13.54.05.* ENTER EDIT
15.46.15.* END EDIT
15.46.15.     END  TRIAL
15.46.15.    ...  ...  CP SECONDS EXECUTION TIME
15.46.15.DERIVE,...
15.48.12.COPY,TAPE8,TAPE...
15.48.50.  END OF INFORMATION ENCOUNTERED.
15.47.41.  ERIF  ...
15.47.41.REWIND,TAPE8.
15.47.41.COPYBR,BT,TAPE8.*
15.49.02.EOI ENCOUNTERED      0 FILES
15.49.04.JOBEND.     $  166.94
```

Permanent File - 5000 Records

```
JOB COST  [illegible]  FRI, OCT 7 [illegible]  17.11.24   $  233.49 (NORMAL)

 PROCESSING                                                $   22.91
   CP                        .51  SEC        $    9.51
   IO                      78.  SEC          $   13.40
 MEMORY UTILIZATION                                        $   82.82
                         76788  KB-HRS       $   82.82
 MASS STORAGE                                              $   31.43
   PERM                    [illegible]  TRK   $    5.16
   [illegible]             4160  TRK         $   26.27
 I/O PROCESSING                                            $   86.29
   LP                   103104  LINES        $   86.27
   CR                       1.  CARDS        $    0.02
 I/O MATERIALS                                             $   10.04
   LP                     1072  PAGES        $   10.04
                                                           --------
 TOTAL COST                                                $  233.49

 PF ACCUMULATED RATE FOR DAY                 $   27.
 ACCOUNT [illegible]                         $ 377.62

          [illegible]  CYBER 170/730. CYBIS NOS/BE 1.5 - 3.1

15.16.[illegible]
15.19. [illegible]
[illegible]
15.[illegible]
15.[illegible]
[illegible]
15.21.00.  [illegible]
15.21.36.  [illegible]
[illegible]
17.00.[illegible]
17.[illegible]  [illegible] EXECUTION TIME
17.[illegible]
17.04.[illegible]
17.17.5[illegible]  [illegible] ENCOUNTERED.
17.03.22.[illegible]
17.03.22.[illegible]
17.11.24.[illegible]  0 FILES
17.11.25.[illegible]
```

Permanent File - 7000 Records

```
JOB COST  J072CCG  PTCA/J072 78/04/21  21.07.59   $  298.33 (NORMAL)

 PROCESSING                                       $   28.98
   CP                 481  SEC        $   12.02
   PP                 954  SEC        $   16.96
 MEMORY OCCUPANCY                                 $  105.75
   CM               16022  WD-HRS     $  105.75
 MASS STORAGE                                     $   39.78
   MSPRU           110259  PRU        $    6.62
   MSACC            17922  ACC        $   33.16
 I/O PROCESSING                                   $  110.92
   LP              135238  LINES      $  110.90
   CR                  18  CARDS      $    0.02
 I/O MATERIALS                                    $   12.90
   LP                2149  PAGES      $   12.90
                                                    --------
 TOTAL COST                                       $  298.33

 PF ACCUMULATION RATE PER DAY          $   19.40
 ACCOUNT BALANCE                       $   99.56


         J072CCG.   78/04/21. CU16 KRONOS 2.1 - 9.1


20.42.30.J072,CM=132000,TL=10000.
20.42.30. CCID/PW VALIDATED.
20.42.31.PROJECT,PTCA.
20.42.31.SETLIM(PR=60000)
20.42.32.ATTACH,TRIAL/PJ=PLIB,ID=POOL.
20.42.33.ATTACH,TAPE1=DB9000/POOL.
20.42.34.TRIAL,PL=600000.
20.42.36.* ENTER TRIAL
20.42.36.* ENTER EDIT
21.04.00.* END EDIT
21.04.00.      END  TRIAL
21.04.00.    450.974 CP SECONDS EXECUTION TIME
21.04.00.DEFINE,T9000.
21.04.01.COPY,TAPE2,T9000,V.
21.04.50. END OF INFORMATION ENCOUNTERED.
21.05.35. VERIFY GOOD.
21.05.35.REWIND,TAPE6.
21.05.36.COPYRF,BF,TAPE6.
21.07.59.EOI ENCOUNTERED      0 FILES
21.08.00.JOBEND.     $  298.33
```

Permanent File - 9000 Records

Appendix B

Keyword Title Indexes - Day Files

```
JOB COST  J072CCH  PTCA/J072 78/04/13  15.38.28   $   39.27 (NORMAL)

 PROCESSING                                       $    4.87
   CP                    80  SEC       $    2.00
   PP                   182  SEC       $    2.87
 MEMORY OCCUPANCY                                 $   18.95
   CM                 2671   MD-HRS    $   18 95
 MASS STORAGE                                     $    6.74
   MSPRU             31583   PRU       $    1.90
   MSACC               261   ACC       $    4.84
 I/O PROCESSING                                   $    7.75
   LP                 9308   LINES     $    7.66
   CR                  103   CARDS     $    0.09
 I/O MATERIALS                                    $    0.96
   LP                  159   PAGES     $    0.96
                                                  --------
 TOTAL COST                                       $   39.27

 PF ACCUMULATION RATE PER DAY          $   12.77
 ACCOUNT BALANCE                       $  611.31


         J072CCH.   78/04/13. CU16 KRONOS 2.1 - 9.1


15.31.30.J072.CM=132000.TL=600.
15.31.31.  CCID/PW VALIDATED.
15.31.31.  [illegible]
15.31.33.SET,TMP=J0CCH
15.31.33.ATTACH,TRIAL,ID=POOL.
15.31.34.[illegible]
15.32.31.TRIAL,PL=100000.
15.32.31.* ENTER TRIAL
15.32.33.* ENTER INDEX
15.33.01.* END INDEX
15.33.02.* ENTER SORT
15.33.02.
15.36.55.  ** INSERTIONS DURING INPUT    *********0
15.36.55.  ** DELETIONS DURING INPUT     *********0
15.36.55.  ** TOTAL RECORDS SORTED       *****13565
15.36.55.  ** INSERTIONS DURING OUTPUT   *********0
15.36.55.  ** DELETIONS DURING OUTPUT    *****13565
15.36.55.  ** TOTAL RECORDS OUTPUT       *********0
15.36.55.  **END SORT RUN
15.36.56.* END SORT
15.36.57.* ENTER PRINT
15.36.28.* END PRINT
15.38.28.      END  TRIAL
15.38.28.     79.634 CP SECONDS EXECUTION TIME
15.38.31.JCDEND.     $   39.27
```

Keyword Title - 1000 Records

```
JOB COST  J072CCS   PTCA,J072 78/04/12  15.23.03   $  117.32 (NORMAL)

 PROCESSING                                          $   14.19
   CP                  245  SEC        $    6.15
   PP                  453  SEC        $    8.04
 MEMORY OCCUPANCY                                    $   58.69
   CM                 8922  WD-HRS     $   58.89
 MASS STORAGE                                        $   18.73
   MSPRU             92363  PRU        $    5.58
   MSACC              7106  ACC        $   13.15
 I/O PROCESSING                                      $   22.72
   LP                27596  LINES      $   22.63
   CR                  105  CARDS      $    0.09
 I/O MATERIALS                                       $    2.79
   LP                  464  PAGES      $    2.79
                                                     ---------
 TOTAL COST                                          $  117.32

 PF ACCUMULATION RATE PER DAY          $   15.05
 ACCOUNT BALANCE                       $  866.10


         J072CCS.   78/04/12. CU20 KRONOS 2.1 - 9.0


13.53.21.J072.CM=130000.TL=600.
13.53.23. CCID=PA VALIDATED.
13.53.26.PWD=SET,ST=A.
13.53.27.SETLIM(PR=(5000))
13.53.28.ATTACH,TRIAL/PU=PLIB,ID=POOL.
13.53.29.ATTACH,TRIAL,ID=POOL.
13.55.10.TRIAL.PL=100000.
13.55.10.* ENTER TRIAL
13.55.11.* ENTER INDEX
13.59.47.* END INDEX
13.59.47.* ENTER SORT
13.59.47.
13.59.47.
14.35.13. ** INSERTIONS DURING INPUT     *********0
14.36.13. ** DELETIONS DURING INPUT      *********0
14.36.13. ** TOTAL RECORDS SORTED        *****40695
14.36.13. ** INSERTIONS DURING OUTPUT    *********0
14.36.13. ** DELETIONS DURING OUTPUT     *****40695
14.36.13. ** TOTAL RECORDS OUTPUT        *********0
14.36.13. **END SORT RUN
14.36.14.* END SORT
14.36.15.* ENTER PRINT
15.23.03.* END PRINT
15.23.03.      END  TRIAL
15.23.03.    245.645 CP SECONDS EXECUTION TIME
15.23.04.JODEND.     $  117.32
```

Keyword Tile - 3000 Records

```
JOB COST  J072DBB  PTCA/J072 78/04/18  17.50.50   $  209.48 (NORMAL)

 PROCESSING                                       $   25.55
   CP                  422  SEC        $   10.55
   PP                  844  SEC        $   15.00
 MEMORY OCCUPANCY                                 $  106.79
   CM                16180  WD-HRS     $  106.79
 MASS STORAGE                                     $   34.91
   MSPRU            179019  PRU        $   10.75
   MSACC             1305  ACC        $   24.16
 I/O PROCESSING                                   $   37.62
   LP                45878  LINES      $   37.62
 I/O MATERIALS                                    $    4.61
   LP                  768  PAGES      $    4.61
                                                  ---------
 TOTAL COST                                       $  209.48

 PF ACCUMULATION RATE PER DAY          $   25.86
 ACCOUNT OVERSPENT                     $  202.37


         J072DBB.   78/04/18. CU16 KRONOS 2.1 - 9.1

14.44.06. SUBMITTED JOB.
14.44.07.J072,CM=132000,TL=2000,JI=TRIAL.
14.44.07. CCID/PW PREVIOUSLY VALIDATED.
14.44.07.$PROJECT(PTCA)
14.44.10.ATTACH,TRIAL/PJ=PLIB,POOL.
14.44.12.SETLIM (PR=3000)
14.44.13.SETID(OUTPUT=XU)
14.44.13.ATTACH,TAPE1=T5000.
14.56.09.TRIAL,PL=200000.
14.56.17.* ENTER TRIAL
14.56.18.* ENTER INDEX
15.31.43.* END INDEX
15.31.43.* ENTER SORT
15.31.43.
15.31.43.
17.39.51. ** INSERTIONS DURING INPUT    *********0
17.39.52. ** DELETIONS DURING INPUT     *********0
17.39.52. ** TOTAL RECORDS SORTED       *****67825
17.39.57. ** INSERTIONS DURING OUTPUT   *********0
17.39.57. ** DELETIONS DURING OUTPUT    *****67825
17.39.58. ** TOTAL RECORDS OUTPUT       *********0
17.39.58. **END SORT RUN
17.40.00.* END SORT
17.40.00.* ENTER PRINT
17.50.49.* END PRINT
17.50.50.      END  TRIAL
17.50.50.    421.578 CP SECONDS EXECUTION TIME
17.50.51.JOBEND.     $  209.48
```

Keyword Title - 5000 Records

```
JOB COST  J072CCT  PTCA/J072 78/04/20  13.16.09   $  304.97 (NORMAL)

PROCESSING                                        $   37.51
  CP                  618  SEC        $   15.44
  PP                 1242  SEC        $   22.07
MEMORY OCCUPANCY                                  $  156.97
  CM                23783  WD-HRS     $  156.97
MASS STORAGE                                      $   51.38
  MSPRU            265326  PRU        $   15.92
  MSACC             19163  ACC        $   35.46
I/O PROCESSING                                    $   52.67
  LP                64118  LINES      $   52.58
  CR                  105  CARDS      $    0.09
I/O MATERIALS                                     $    6.44
  LP                 1072  PAGES      $    6.44
                                                  ---------
TOTAL COST                                        $  304.97

PF ACCUMULATION RATE PER DAY          $   25.03
ACCOUNT BALANCE                       $  442.66

        J072CCT.   78/04/20. CU16 KRONOS 2.1 - 9.1

11.38.12.J072,CM=132000,TL=6000.
11.38.12. CCID/PW VALIDATED.
11.38.12.PROJECT,PTCA.
11.38.13.SETLIM(PR=30000)
11.38.14.ATTACH,TRIAL/P=PLIB,ID=POOL.
11.38.15.ATTACH,TAPE1=T7000.
11.38.16.TRIAL,PL=200000.
11.38.16.* ENTER TRIAL
11.38.17.* ENTER INDEX
11.52.07.* END INDEX
11.52.08.* ENTER SORT
11.52.08.
11.52.08.
13.00.42. ** INSERTIONS DURING INPUT    *********0
13.00.42. ** DELETIONS DURING INPUT     *********0
13.00.43. ** TOTAL RECORDS SORTED       *****94955
13.00.43. ** INSERTIONS DURING OUTPUT   *********0
13.00.43. ** DELETIONS DURING OUTPUT    *****94955
13.00.43. ** TOTAL RECORDS OUTPUT       *********0
13.00.43. **END SORT RUN
13.00.44.* END SORT
13.00.45.* ENTER PRINT
13.16.08.* END PRINT
13.16.09.      END  TRIAL
13.16.09.   617.178 CP SECONDS EXECUTION TIME
13.16.10.JOBEND.     $  304.97
```

Keyword Title - 7000 Records

```
JOB COST  J072CCD  PTCA/J072 78/04/24  20.44.32   $  390.72 (NORMAL)

 PROCESSING                                       $   48.06
   CP                 704  SEC       $   19.84
   PP                1587  SEC       $   28.22
 MEMORY OCCUPANCY                                 $  201.07
   CM               30484  KD-HRS    $  201.07
 MASS STORAGE                                     $   65.67
   MSPRU           344490  PRU       $   20.67
   MSACC            24320  ACC       $   45.00
 I/O PROCESSING                                   $   67.65
   LP               82383  LINES     $   67.56
   CR                 105  CARDS     $    0.09
 I/O MATERIALS                                    $    8.27
   LP                1377  PAGES     $    8.27
                                                  ---------
 TOTAL COST                                       $  390.72

 PF ACCUMULATION RATE PER DAY       $   19.--
 ACCOUNT OVERSPENT                  $  344.39


         J072CCD.   78/04/24. CU16 KRONOS 2.1 - 9.1


16.51.53.J072,CM=130000,TL=40000.
16.51.54. CCID/PW VALIDATED.
16.51.54.PTCART/PTCA
16.51.57.SETLIB(PR=10.1060)
16.51.58.ATTACH,.PTXL/UN=PLIB,ID=POOL.
16.51.59.ATTACH,TAPE1=Y0000.
16.52.12.TRIAL,PL=1000000.
16.52.12.* ENTER TRIAL
16.52.13.* ENTER INDEX
17.11.03.* END INDEX
17.11.03.* ENTER SORT
17.11.03.
17.11.03.
20.33.16.  0.  ** INSERTIONS DURING INPUT    **********0
20.33.16.  0.  ** DELETIONS DURING INPUT     **********0
20.33.16.  ** TOTAL RECORDS SORTED           ****122005
20.33.16.  ** INSERTIONS DURING OUTPUT       **********0
20.33.16.  ** DELETIONS DURING OUTPUT        ****122005
20.33.16.  ** TOTAL RECORDS OUTPUT           **********0
20.33.16.* END SORT ASM
20.33.17.* END SORT
20.33.18.* ENTER PRINT
20.44.31.* END PRINT
20.44.31.      END  TRIAL
20.44.31.    793.504 CP SECONDS EXECUTION TIME
20.44.33.JOBEND.     $  390.72
```

Keyword Title - 9000 Records

Appendix C

Command Statements

Permanent file for 1000 records

```
jobcard  CM=132000,TL=100.
password
project
SETLIM(PR=500)
ATTACH,TRIAL/PJ=PLIB,ID=POOL.
GET,TAPE1=DB1000/POOL.
TRIAL.
SAVE,TAPE2=T1000.
REWIND,TAPE6.
COPYBF,BF,TAPE6.
7/8/9
*EDIT
NEW MASTER=2, LIST=6, INPUT=1.
*DATA
*INSERT,ENTRY=10, INCREMENT=10.
*END
6/7/8/9
```

Keyword title index for 1000 records

```
jobcard CM=132000,TL=300.
password
project
ATTACH,TRIAL/PJ=PLIB,ID=POOL.
GET,TAPE1=T1000.
TRIAL.
7/8/9
*MASTER=1.
*INDEX
*WORDS,TITLE,CARDS(2).
STOPWORDS
*KWOC,TITLE,CARDS(0,1,2,3,4,5,6,7,8,9).
*END
*PRINT
OK.
*END
6/7/8/9
```

Permanent file for 3000 records

```
jobcard CM=132000,TL=300.
password
project
SETLIM(PR=1500)
ATTACH,TRIAL/PJ=PLIB,ID=POOL.
GET,TAPE1=DB3000/POOL.
TRIAL.
DEFINE,T3000.
COPY,TAPE2,T3000,V.
REWIND,TAPE6.
COPYRF,BF,TAPE6.
7/8/9
*EDIT
NEW MASTER=2, LIST=6, INPUT=1.
*DATA
*INSERT,ENRTY=10, INCREMENT=10.
*END
6/7/8/9
```

Keyword title index for 3000 records

```
jobcardCM=132000,TL=600.
password
project
SETLIM(PR=15000)
ATTACH,TRIAL/PJ=PLIB,ID=POOL.
ATTACH,TAPE1=T3000.
TRIAL,PL=100000.
7/8/9
*MASTER=1.
*INDEX
*WORDS,TITLE,CARDS(2).
STOPWORDS
*KWOC,TITLE,CARDS(0,1,2,3,4,5,6,7,8,9).
*END
*PRINT
OK.
*END
6/7/8/9
```

Permanent file for 5000 records

```
jobcard  CM=132000,TL=600.
password
project
SETLIM(PR=3000)
ATTACH,TRIAL/PJ=PLIB,ID=POOL.
ATTACH,TAPE1=DB5000/POOL.
TRIAL.
DEFINE,T5000.
COPY,TAPE2,T5000,V..
REWIND,TAPE6.
COPYRF,BF,TAPE6.
7/8/9
*EDIT
NEW MASTER=2, LIST=6, INPUT=1.
*DATA
*INSERT,ENTRY=10, INCREMENT=10.
*END
6/7/8/9
```

Keyword title index for 5000 records

```
jobcard  CM=132000,TL=2000.
password
project
SETLIM(PR=3000)
ATTACH,TRIAL/PJ=PLIB,ID=POOL.
ATTACH,TAPE1=T5000.
TRIAL,PL=200000.
7/8/9
*MASTER=1.
*INDEX
*WORDS,TITLE,CARDS(2).
STOPWORDS
*KWOC,TITLE,CARDS(0,1,2,3,4,5,6,7,8,9).
*END
*PRINT
OK.
*END
6/7/8/9
```

Permanent file for 7000 records

```
jobcard CM=132000,TL=1000.
password
project
SETLIM(PR=15000)
ATTACH,TRIAL/PJ=PLIB,ID=POOL.
ATTACH,TAPE1=DB7000/POOL.
TRIAL.
DEFINE,T7000.
COPY,TAPE2,T7000,V.
REWIND,TAPE6.
COPYBF,BF,TAPE6.
7/8/9
*EDIT
NEW MASTER=2, LIST=6, INPUT=1.
*DATA
*INSERT,ENTRY=10, INCREMENT=10.
*END
6/7/8/9
```

Keyword title index for 7000 records

```
jobcard  CM=132000,TL=6000.
password
project
SETLIM(PR=30000)
ATTACH,TRIAL/PJ=PLIB,ID=POOL.
ATTACH,TAPE1=T7000.
TRIAL,PL=300000.
7/8/9
*MASTER=1.
*INDEX
*WORDS,TITLE,CARDS(2).
STOPWORDS
*KWOC,TITLE,CARDS(0,1,2,3,4,5,6,7,8,9).
*END
*PRINT
OK.
*END
6/7/8/9
```

Permanent file for 9000 records

```
jobcard CM=132000,TL=10000.
password
project
SETLIM(PR=60000)
ATTACH,TRIAL/PJ=PLIB,ID=POOL.
ATTACH,TAPE1=DB9000/POOL.
TRIAL.
DEFINE,T9000.
COPY,TAPE2,T9000,V.
REWIND,TAPE6.
7/8/9
*EDIT
NEW MASTER=2, LIST=6, INPUT=1.
*DATA
*INSERT,ENTRY=10, INCREMENT=10.
*END
6/7/8/9
```

Keyword title index for 9000 records

```
jobcard  CM=132000,TL=40000.
password
project
SETLIM(PR=30000)
ATTACH,TRIAL/PJ=PLIB,ID=POOL.
ATTACH,TAPE1=T9000.
TRIAL,PL=100000.
7/8/9
*MASTER=1.
*INDEX
*WORDS,TITLE,CARDS(2).
STOPWORDS
*KWOC,TITLE,CARDS(0,1,2,3,4,5,6,7,8,9).
*END
*PRINT
OK.
*END
6/7/8/9
```